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former have the advantage of being readily apprehended, those of the latter of being mathematically exact.

Sir Henry Roscoe deserves the thanks of all workers in chemistry for having provided them with an unusually interesting biography of one of the founders of the science.

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*Elasticität und Festigkeit.* By C. BACH, Professor in the Technical High School at Stuttgart. Second Edition. Berlin, Julius Springer. 1894. Octavo, 432 pages and xiv plates.

In this work the author lays down the guiding principle that the student of mechanics of materials should first of all become acquainted with the actual phenomena of stress. To this end photographic illustrations are given exhibiting the deformations of bars under tension, of blocks under compression, of beams and plates under flexure and of shafts under torsion. These illustrations are most useful and show the typical changes of form in a beautiful manner. Nevertheless their value is probably not so great as the author assumes, for nearly all the theories and computations of the mechanics of materials are confined to the case where the elastic strength is not exceeded and where changes of form are not perceptible to the eye.

The modulus or coefficient of elasticity, usually represented by the letter  $E$ , is not employed in this book. Instead its reciprocal is used and called the extension coefficient, which may be defined as the stretch of a bar per unit of length due to a stress of unity on each square unit of cross section. There can be no doubt but that the term coefficient of elasticity is a most unfortunate one, as it has no relation to elasticity in the ordinary sense of the word, but is a measure of stiffness or rigidity. The improvement desired would be a

change of name rather than the introduction of a new term and symbol. Even the author, who uses the new constant consistently in all his formulas, rarely gives numerical values for it, but expresses these in terms of its reciprocal, which is, of course, the coefficient of elasticity as universally employed.

The scope of the work is that of a textbook on the mechanics of materials and of beams, columns and shafts, suitable for technical schools which desire to avoid extended mathematical discussions. The usual theoretic formulas are demonstrated in a neat manner, and many results of tests are presented; those on circular, elliptical and rectangular plates may in particular be noted as novel and valuable. The subject of internal work or resilience is discussed more fully than in British or American books. True internal stresses resulting from the change of shape are properly used in the treatment of cylinders, spheres and plates; owing to the neglect of this precaution, formulas based upon apparent stresses, like those of Rankine, are liable to give values often deviating twenty-five per cent. from the truth.

The formula for the design of columns, long used in the United States under the name of Gordon's formula or Rankine's formula, has not been employed in Germany to the extent that its value demands. The author, however, emphasizes it as an important rule, and gives empirical constants for its use. He also states that the formula was first deduced by Navier; on referring to Navier's works this statement is not found to be justified, it being only mentioned that the stress on the concave side of the column is the sum of the stresses due to direct compression and to lateral flexure, while no formula similar to Gordon's is established.

On the whole, the perusal of the book leaves the impression that the author has

done his work with much painstaking care, and that both the theoretical and the practical part are set forth in a manner which cannot fail to give students an excellent foundation in the science of the elasticity and strength of materials.

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*The Pocket Gophers of the United States.* Bulletin No. 5, U. S. Department of Agriculture, Division of Ornithology and Mammalogy. Prepared under the direction of DR. C. HART MERRIAM, Chief of division, by VERNON BAILEY, Chief Field Agent, Central Park, New York. Published by authority of the Secretary of Agriculture. Washington, Government Printing Office. 1895. 8vo., pp. 47. Frontispiece, 6 cuts in the text, and colored map.

In a former number of SCIENCE (N. S. Vol. I., No. 9, March 1, 1895) attention was called to a monograph by Dr. Merriam on the Pocket Gophers (family Geomyidæ), in which was presented the scientific results of his extended and detailed studies of the group. The present 'Bulletin' is a fitting sequel to the technical monograph already noticed, dealing, as it does, with the economic relations to agriculture of these destructive rodents. This paper was prepared by Mr. Vernon Bailey, under the direction of Dr. Merriam, Chief of the Division of Ornithology and Mammalogy of the U. S. Department of Agriculture. Mr. Bailey is one of the most experienced and expert of the many expert field naturalists now connected with this branch of government service, and is therefore eminently fitted by personal experience in the field for the preparation of a report like the one under notice.

The first ten pages relate to the general habits of these animals, which live almost wholly under ground, and make known their presence chiefly by the mounds of earth

thrown out from their burrows, or by their troublesome depredations upon farm and garden products. Even where so numerous as to be exceedingly troublesome they are rarely seen, and little is known of their life habits by even the people who suffer from their depredations. Hence the detailed account of their habits and methods of working here given is a welcome contribution toward a fuller knowledge of their life histories. Although deficient in vision, their senses of taste, touch and smell seem to be compensatingly acute, and their ample external cheek-pouches serve an important function in the transportation of food, for which they seem exclusively used. The Gophers, says Mr. Bailey, "are industrious workers, and whatever food is found and not needed at once is carried to chambers in some part of the tunnel and stored. \* \* \* Sometimes a peck of small potatoes, roots of coco grass, wild parsnip, wild sunflower and other fleshy or bulbous roots are found in a single chamber." They are especially fond of potatoes, turnips, carrots, beets, onions, parsnips, corn, barley, rye and alfalfa, and even squashes and melons do not escape their ravages. They are also very destructive to fruit and ornamental trees by eating off their roots, which are sometimes so thoroughly cut away that the trees fall from lack of support. Their burrows are also often a source of injury over comparatively large areas, through the large amount of earth thrown up as mounds, thus burying crops, and sometimes they cause breaks in irrigating ditches and induce serious washing of hillside lands.

The Gophers have few natural enemies, and seem to flourish and increase through the fruits of man's industry. Hence the question of artificial means of destruction becomes a matter for careful consideration. They can be trapped readily by those who know how to do it, but generally the art is unknown, and it is a widespread belief